

F ENT COOPERATION TREA

PCT

NOTIFICATION OF THE RECORDING
OF A CHANGE(PCT Rule 92bis.1 and
Administrative Instructions, Section 422)

From the INTERNATIONAL BUREAU

To:

SLINGSBY, Philip, Roy
Page White & Farrer
54 Doughty Street
London WC1N 2LS
ROYAUME-UNI

Date of mailing (day/month/year) 12 September 2000 (12.09.00)	IMPORTANT NOTIFICATION
Applicant's or agent's file reference 91242/PRS	
International application No. PCT/GB99/00741	International filing date (day/month/year) 12 March 1999 (12.03.99)

1. The following indications appeared on record concerning:

☒ the applicant ☐ the inventor ☐ the agent ☐ the common representative

Name and Address

CAMBRIDGE DISPLAY TECHNOLOGY LTD.
181a Huntingdon Road
Cambridge CB3 0DJ
United Kingdom

State of Nationality

GB

State of Residence

GB

Telephone No.

Facsimile No.

Teleprinter No.

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

☐ the person ☐ the name ☒ the address ☐ the nationality ☐ the residence

Name and Address

CAMBRIDGE DISPLAY TECHNOLOGY LTD.
Greenwich House
Madingley Rise
Madingley Road
Cambridge CB3 0HJ
United Kingdom

State of Nationality

GB

State of Residence

GB

Telephone No.

Facsimile No.

Teleprinter No.

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

<input checked="" type="checkbox"/> the receiving Office	<input type="checkbox"/> the designated Offices concerned
<input type="checkbox"/> the International Searching Authority	<input checked="" type="checkbox"/> the elected Offices concerned
<input type="checkbox"/> the International Preliminary Examining Authority	<input type="checkbox"/> other:

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Authorized officer

Sean Taylor

Facsimile No.: (41-22) 740.14.35

Telephone No.: (41-22) 338.83.38

PATENT COOPERATION TREATY

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Assistant Commissioner for Patents
United States Patent and Trademark
Office
Box PCT
Washington, D.C.20231
ÉTATS-UNIS D'AMÉRIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 08 November 1999 (08.11.99)	
International application No. PCT/GB99/00741	Applicant's or agent's file reference 91242/PRS
International filing date (day/month/year) 12 March 1999 (12.03.99)	Priority date (day/month/year) 13 March 1998 (13.03.98)
Applicant BURROUGHES, Jeremy, Henley et al	

1. The designated Office is hereby notified of its election made:

☒ in the demand filed with the International Preliminary Examining Authority on:
13 October 1999 (13.10.99)

☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was
☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer Juan Cruz Telephone No.: (41-22) 338.83.38
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PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

PCT

NOTIFICATION OF TRANSMITTAL OF
THE INTERNATIONAL SEARCH REPORT
OR THE DECLARATION

(PCT Rule 44.1)

To:

PAGE WHITE & FARRER
Attn. SLINGSBY, P.
54 Doughty Street
LONDON WC1N 2LS
UNITED KINGDOM

RECEIVED

19 JUL 1999

Ans'd

Date of mailing
(day/month/year)

15/07/1999

Applicant's or agent's file reference

91242/PRS

FOR FURTHER ACTION

See paragraphs 1 and 4 below

International application No.

PCT/GB 99/ 00741

International filing date

(day/month/year)

12/03/1999

Applicant

CAMBRIDGE DISPLAY TECHNOLOGY LTD et al.

1. ☒ The applicant is hereby notified that the International Search Report has been established and is transmitted herewith.

Filing of amendments and statement under Article 19:

The applicant is entitled, if he so wishes, to amend the claims of the International Application (see Rule 46):

When? The time limit for filing such amendments is normally 2 months from the date of transmittal of the International Search Report; however, for more details, see the notes on the accompanying sheet.

Where? Directly to the International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland
Fascimile No.: (41-22) 740.14.35

For more detailed instructions, see the notes on the accompanying sheet.

2. ☐ The applicant is hereby notified that no International Search Report will be established and that the declaration under Article 17(2)(a) to that effect is transmitted herewith.

3. ☐ With regard to the protest against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

☐ the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.

☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Further action(s):** The applicant is reminded of the following:

Shortly after 18 months from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau as provided in Rules 90bis.1 and 90bis.3, respectively, before the completion of the technical preparations for international publication.

Within 19 months from the priority date, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase until 30 months from the priority date (in some Offices even later).

Within 20 months from the priority date, the applicant must perform the prescribed acts for entry into the national phase before all designated Offices which have not been elected in the demand or in a later election within 19 months from the priority date or could not be elected because they are not bound by Chapter II.

Name and mailing address of the International Searching Authority



European Patent Office, P.B. 5818 Patentlaan 2
NL-2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Marjory Sastropawiro

NOTES TO FORM PCT/ISA/220

These Notes are intended to give the basic instructions concerning the filing of amendments under article 19. The Notes are based on the requirements of the Patent Cooperation Treaty, the Regulations and the Administrative Instructions under that Treaty. In case of discrepancy between these Notes and those requirements, the latter are applicable. For more detailed information, see also the PCT Applicant's Guide, a publication of WIPO.

In these Notes, "Article", "Rule", and "Section" refer to the provisions of the PCT, the PCT Regulations and the PCT Administrative Instructions respectively.

INSTRUCTIONS CONCERNING AMENDMENTS UNDER ARTICLE 19

The applicant has, after having received the international search report, one opportunity to amend the claims of the international application. It should however be emphasized that, since all parts of the international application (claims, description and drawings) may be amended during the international preliminary examination procedure, there is usually no need to file amendments of the claims under Article 19 except where, e.g. the applicant wants the latter to be published for the purposes of provisional protection or has another reason for amending the claims before international publication. Furthermore, it should be emphasized that provisional protection is available in some States only.

What parts of the international application may be amended?

Under Article 19, only the claims may be amended.

During the international phase, the claims may also be amended (or further amended) under Article 34 before the International Preliminary Examining Authority. The description and drawings may only be amended under Article 34 before the International Examining Authority.

Upon entry into the national phase, all parts of the international application may be amended under Article 28 or, where applicable, Article 41.

When?

Within 2 months from the date of transmittal of the international search report or 16 months from the priority date, whichever time limit expires later. It should be noted, however, that the amendments will be considered as having been received on time if they are received by the International Bureau after the expiration of the applicable time limit but before the completion of the technical preparations for international publication (Rule 46.1).

Where not to file the amendments?

The amendments may only be filed with the International Bureau and not with the receiving Office or the International Searching Authority (Rule 46.2).

Where a demand for international preliminary examination has been/is filed, see below.

How?

Either by cancelling one or more entire claims, by adding one or more new claims or by amending the text of one or more of the claims as filed.

A replacement sheet must be submitted for each sheet of the claims which, on account of an amendment or amendments, differs from the sheet originally filed.

All the claims appearing on a replacement sheet must be numbered in Arabic numerals. Where a claim is cancelled, no renumbering of the other claims is required. In all cases where claims are renumbered, they must be renumbered consecutively (Administrative Instructions, Section 205(b)).

The amendments must be made in the language in which the international application is to be published.

What documents must/may accompany the amendments?

Letter (Section 205(b)):

The amendments must be submitted with a letter.

The letter will not be published with the international application and the amended claims. It should not be confused with the "Statement under Article 19(1)" (see below, under "Statement under Article 19(1)").

The letter must be in English or French, at the choice of the applicant. However, if the language of the international application is English, the letter must be in English; if the language of the international application is French, the letter must be in French.

NOTES TO FORM PCT/ISA/220 (continued)

The letter must indicate the differences between the claims as filed and the claims as amended. It must, in particular, indicate, in connection with each claim appearing in the international application (it being understood that identical indications concerning several claims may be grouped), whether

- (i) the claim is unchanged;
- (ii) the claim is cancelled;
- (iii) the claim is new;
- (iv) the claim replaces one or more claims as filed;
- (v) the claim is the result of the division of a claim as filed.

The following examples illustrate the manner in which amendments must be explained in the accompanying letter:

1. [Where originally there were 48 claims and after amendment of some claims there are 51]:
"Claims 1 to 29, 31, 32, 34, 35, 37 to 48 replaced by amended claims bearing the same numbers; claims 30, 33 and 36 unchanged; new claims 49 to 51 added."
2. [Where originally there were 15 claims and after amendment of all claims there are 11]:
"Claims 1 to 15 replaced by amended claims 1 to 11."
3. [Where originally there were 14 claims and the amendments consist in cancelling some claims and in adding new claims]:
"Claims 1 to 6 and 14 unchanged; claims 7 to 13 cancelled; new claims 15, 16 and 17 added." or
"Claims 7 to 13 cancelled; new claims 15, 16 and 17 added; all other claims unchanged."
4. [Where various kinds of amendments are made]:
"Claims 1-10 unchanged; claims 11 to 13, 18 and 19 cancelled; claims 14, 15 and 16 replaced by amended claim 14; claim 17 subdivided into amended claims 15, 16 and 17; new claims 20 and 21 added."

"Statement under article 19(1)" (Rule 46.4)

The amendments may be accompanied by a statement explaining the amendments and indicating any impact that such amendments might have on the description and the drawings (which cannot be amended under Article 19(1)).

The statement will be published with the international application and the amended claims.

It must be in the language in which the international application is to be published.

It must be brief, not exceeding 500 words if in English or if translated into English.

It should not be confused with and does not replace the letter indicating the differences between the claims as filed and as amended. It must be filed on a separate sheet and must be identified as such by a heading, preferably by using the words "Statement under Article 19(1)."

It may not contain any disparaging comments on the international search report or the relevance of citations contained in that report. Reference to citations, relevant to a given claim, contained in the international search report may be made only in connection with an amendment of that claim.

Consequence if a demand for international preliminary examination has already been filed

If, at the time of filing any amendments under Article 19, a demand for international preliminary examination has already been submitted, the applicant must preferably, at the same time of filing the amendments with the International Bureau, also file a copy of such amendments with the International Preliminary Examining Authority (see Rule 62.2(a), first sentence).

Consequence with regard to translation of the international application for entry into the national phase

The applicant's attention is drawn to the fact that, where upon entry into the national phase, a translation of the claims as amended under Article 19 may have to be furnished to the designated/elected Offices, instead of, or in addition to, the translation of the claims as filed.

For further details on the requirements of each designated/elected Office, see Volume II of the PCT Applicant's Guide.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 91242/PRS	FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. PCT/GB 99/ 00741	International filing date (day/month/year) 12/03/1999	(Earliest) Priority Date (day/month/year) 13/03/1998
Applicant CAMBRIDGE DISPLAY TECHNOLOGY LTD et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.



It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.



the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :



contained in the international application in written form.



filed together with the international application in computer readable form.



furnished subsequently to this Authority in written form.



furnished subsequently to this Authority in computer readable form.



the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.



the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,



the text is approved as submitted by the applicant.



the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,



the text is approved as submitted by the applicant.



the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.



as suggested by the applicant.



because the applicant failed to suggest a figure.



because this figure better characterizes the invention.



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None of the figures.

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H01L51/20

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H01L H05B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	PATENT ABSTRACTS OF JAPAN vol. 097, no. 007, 31 July 1997 -& JP 09 082473 A (CASIO COMPUT CO LTD), 28 March 1997 see abstract; figures -& US 5 834 894 A (SHIRASAKI T ET AL) 10 November 1998 ---	1, 36, 55, 56, 60
A	YANG Y ET AL: "POLY(1,4-PHENYLENE-1,2-DIPHENYLVINYLENE) AND TRIS(8-QUINOLINOLATO) ALUMINUM BILAYER LIGHT-EMITTING DIODES" POLYMERS FOR ADVANCED TECHNOLOGIES, vol. 8, no. 7, 1 July 1997, pages 431-436, XP000695524 see the whole document ---	1, 36, 55, 56, 60

-/--



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

6 July 1999

Date of mailing of the international search report

15/07/1999

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

De Laere, A

C. (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A:	GARTEN F ET AL: "EFFICIENT BLUE LEDS FROM A PARTIALLY CONJUGATED SI-CONTAINING PPV COPOLYMER IN A DOUBLE-LAYER CONFIGURATION" ADVANCED MATERIALS, vol. 9, no. 2, 1 February 1997, pages 127-131, XP000681079 cited in the application see the whole document -----	1, 36, 55, 56, 60
A	HOSOKAWA C ET AL: "HIGHLY EFFICIENT BLUE ELECTROLUMINESCENCE FROM A DISTYRYLARYLENE EMITTING LAYER WITH A NEW DOPANT" APPLIED PHYSICS LETTERS, vol. 67, no. 26, 25 December 1995, pages 3853-3855, XP000548843 cited in the application see the whole document -----	1, 36, 55, 56, 60

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09/50C0

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INTERNATIONAL COOPERATION TREATY

PCT

REC'D 06 JUN 2000

WIPO PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 91242/PRS	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/GB99/00741	International filing date (day/month/year) 12/03/1999	Priority date (day/month/year) 13/03/1998
International Patent Classification (IPC) or national classification and IPC H01L51/20		
Applicant CAMBRIDGE DISPLAY TECHNOLOGY LTD et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.


2. This REPORT consists of a total of 10 sheets, including this cover sheet.

☐ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☒ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☒ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☒ Certain observations on the international application

Date of submission of the demand 13/10/1999	Date of completion of this report 02.06.2000
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Agne, M Telephone No. +49 89 2399 2631



INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB99/00741

I. Basis of the report

1. This report has been drawn on the basis of (*substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.*):

Description, pages:

1-31 as originally filed

Claims, No.:

1-63 as originally filed

Drawings, sheets:

1-26 as received on 28/04/1999 with letter of 16/04/1999

2. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

4. Additional observations, if necessary:

III. Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:

- ☐ the entire international application.
- ☒ claims Nos. 9-12, 38-41, 59, 63.

because:

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB99/00741

- ☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (*specify*):
- ☒ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. 9-12, 38-41, 59, 63 are so unclear that no meaningful opinion could be formed (*specify*):
- see separate sheet**
- ☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.
- ☐ no international search report has been established for the said claims Nos. .

IV. Lack of unity of invention

1. In response to the invitation to restrict or pay additional fees the applicant has:
- ☐ restricted the claims.
- ☐ paid additional fees.
- ☐ paid additional fees under protest.
- ☐ neither restricted nor paid additional fees.
2. ☒ This Authority found that the requirement of unity of invention is not complied and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.
3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is
- ☐ complied with.
- ☒ not complied with for the following reasons:
- see separate sheet**
4. Consequently, the following parts of the international application were the subject of international preliminary examination in establishing this report:
- ☒ all parts.
- ☐ the parts relating to claims Nos. .

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB99/00741

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	3-8, 15, 18, 19, 21, 26, 27, 30, 31, 33, 44, 45, 48
	No:	Claims	1, 2, 13, 14, 16, 17, 20, 22-25, 28, 29, 32, 34-37, 42, 43, 46, 47, 49-58, 60-62
Inventive step (IS)	Yes:	Claims	3-8, 15, 19, 27, 31, 44
	No:	Claims	1, 2, 13, 14, 16-18, 20-26, 28-30, 32-37, 42, 43, 45-58, 60-62
Industrial applicability (IA)	Yes:	Claims	1-8, 13-37, 42-58, 60-62
	No:	Claims	

2. Citations and explanations

see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

Re Item III

Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

1. The subject-matter of claims **9-12, 38-41, 59** and **63** is so unclear, that a meaningful opinion on the novelty and inventive merit of their subject-matter cannot be formed; for a detailed reasoning, see point **VIII** below.

Re Item IV

Lack of unity of invention

1. The application lacks unity within the meaning of Rule 13(1) to 13(3) PCT.
 - 1.1 The separate groups of inventions are:
 - (i) Light emitting device having a light-emissive layer comprising a mixture of at least two different materials, the mixture having a non-uniform composition; claims **3-8**, claim **15**.
 - (ii) Light emitting device having a light-emissive layer comprising poly-(2,7-(9,9-di-n-octylfluorene)) ("F8"); claims **19** and **44**.
 - (iii) Light emitting device having a type II interface between the light emitting layer and the electron transport or hole transport layer; claims **27** and **31**.
 - 1.2 The common concept linking together these inventions is not novel, see section **V**.

Hence the above-mentioned groups of inventions are not so linked as to form a single general inventive concept.

Re Item V

Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Reference is made to the following documents:

D1: Garten F et al: 'Efficient blue LEDs from a partially conjugated Si-containing PPV copolymer in a double-layer configuration', Advanced Materials, Vol. 9,

No. 2, pages 127-131 (XP000681079)

D2: Hosokawa C et al: 'Highly efficient blue electroluminescence from a distyrylarylene emitting layer with a new dopant', Applied Physics Letters, Vol. 67, No. 26, pages 3853-3855 (XP000548843)

D3: EP-A-0 805 143

D4: Yang Y et al: 'Poly(1,4-phenylene-1,2-diphenylvinylene) and tris(8-quinolinolato) aluminum bilayer light-emitting diodes', Polymers for Advanced Technologies, vol. 8, no. 7, pages 431-436 (XP000695524)

2. The subject-matter of claims **1, 2, 13, 14, 16, 17, 20, 22-25, 28, 29, 32, 34-37, 42, 43, 46, 47, 49-58, and 60-62** is not new in the sense of Article 33(2) PCT.

2.1 Document D1 describes an organic electroluminescent device comprising an anode (ITO), a cathode (Al or Au) and a single layer ("structure 5") or a double layer ("structure 7") disposed therebetween (cf. p.129, particularly the left column). In the single layer structure ("structure 5"), a blend of three components (PVK, SiPPV, and PBD) is used. As the insert in Fig.3 shows, the interface between any two of the three materials (PVK, SiPPV, and PBD) is a "type II" interface. D1 further describes that such blends usually phase-separate (cf. p.128, left column).

As described in D1 (cf. page 128, left column), the luminescent chromophore (SiPPV, 5% by weight) is blended in a transport matrix of PVK. Therefore, it appears that the PVK acts as a hole transporting material, the PBD acts as an electron transporting material, and the SiPPV corresponds to the active (light-emitting) material.

Consequently, the "structure 5" described in D1 comprises the technical features of claims **1, 2, 13, 14** (the phase separation described implies simultaneous deposition), **16, 17** (D1, Fig. 2!), **20** (first component PVK), **22** (third component SiPPV), **23, 24, 25, 28, 29** (cf. D1, below table 1), **32, 34** (ITO is transparent) and **35**.

Therefore, the subject-matter of these claims is not new.

- 2.2 The double layer structure ("structure 7") comprises a light-emitting layer which consists of a blend of two components (PVK and SiPPV), and an electron transport layer (PBD). As mentioned above, the interface between any two of the three materials (PVK, SiPPV, and PBD) is a "type II" interface, and the blend can be expected to be phase-separated.

The "structure 7" comprises the technical features of claims **36, 37, 42, 43** (SiPPV: 2.2eV; PVK: larger than that, cf. Fig.3), **46, 47, 49, 50, 51, 53** and **54**.

- 2.3 Furthermore, the "structure 5" device in D1 also comprises the technical features of claims **36** and **52**, since a blend of three materials can be considered as a mixture comprising two materials.
- 2.4 Document D2 describes an organic electroluminescent device (cf. Fig.1) comprising an anode (ITO), a cathode (Mg:Ag) and four layers disposed therebetween (CuPc; TPD; DPVBi, light-emitting; Alq). As Fig.1 shows, the interface between the TPD and the DPVBi material is a type II interface; since the two materials (TPD and DPVBi) are different, this junction is a heterojunction.

Therefore, the subject-matter of claim **55** is also not new.

- 2.5 The process of forming the "structure 5" device of document D1 clearly also comprises the features of claim **56**, and the blended substances are apparently deposited as a premixed solution (page 128, left column). Thus, the subject-matter of claims **56** and **57** is not new.
- 2.6 The solidification of the first charge carrier injecting layer appears to be a step as described in claim **58**.
- 2.7 The process of forming the "structure 7" device of document D1 clearly also comprises the features of claim **60**, and the blended substances are apparently deposited as a premixed solution (page 128, left column). Thus, the subject-matter of claims **60** and **61** is not new.

- 2.8 The solidification of the first charge carrier injecting layer appears to be a step as described in claim **62**.
3. Dependent claims **18, 21, 26, 30, 33, 45, and 48** do not appear to contain any additional features which, in combination with the features of any claim to which they refer, meet the requirements of the PCT with respect to inventive step, the reasons being as follows:

Claim **18**: Document D3 (cf. page 4, line 55 to page 5, last line, formula I and table 1) describes the use of conjugated polymers comprising amine groups in the hole transporting layer of an organic light-emitting device.

Claim **21**: Document D3 (cf. formula I and table 1-1A and 1-1B: compound HI-1) discloses the use of PFM in the hole transport layer of an organic electroluminescent device.

Claim **26**: It would be obvious for the skilled person to add a hole transport layer to the "structure 5" of D1, in order to improve the efficiency.

Claim **30**: It would also be obvious for the skilled person to add an electron transport layer to the "structure 5" of D1, in order to improve the efficiency.

Claim **33**: It is general practice in the field to select cathode materials with a low workfunction, eg. calcium (2.9eV, cf. D4, page 432, left column).

Claim **45**: see claim 18.

Claim **48**: It would be obvious for the skilled person to add a hole transport layer to the "structure 7" of D1, in order to improve the efficiency.

4. The subject-matter of claims **3-8, 15, 19, 27, 31, 44 and 58** appears to be new and inventive in the sense of Art. 33(2) and (3) EPC.
- 4.1 None of the available prior art documents describes an electroluminescent device having a light emissive layer which comprises a mixture of two or more materials, with a concentration gradient of the composition. Such a device is also not suggested by any of the available documents.

Therefore, the subject-matter of claims **3-8** appears to be new and inventive.

- 4.2 The additional technical features of claims **15, 19, 27, 31, 44** are neither

disclosed in, nor suggested by, any of the available prior art documents.

Re Item VIII

Certain observations on the international application

1. Claims **1-63** are not clear in the sense of Art. 6 PCT.
 - 1.1 On page 2, the HOMO and LUMO energy levels are defined as the "highest occupied molecular orbital" and "lowest unoccupied molecular orbital", respectively. Thus, there can be only one HOMO and one LUMO level per molecule, and consequently, it is meaningless to speak of "type I" or "type II" semiconductor junctions within one molecule.

On the other hand, on page 27, it is described that "either of the charge transporting components plus the light emitting component, or both charge transporting components plus the light emitting component, may be combined in a single molecule".

All independent claims, ie. claims **1, 36, 55, 56, and 60**, speak of type II semiconductor interfaces formed between the first, second and - where present - the third semiconductor components; if the components are however combined in one molecule, this feature is meaningless, and therefore unclear.

Thus, the cited passage from page 27 renders the scope of claims **1-63** unclear in the sense of Art.6 PCT.

- 1.2 For the reasons given in the previous section, the additional technical features of claims **9, 10, 11, and 12** render the scope of these claims so unclear, that a meaningful interpretation is impossible. Therefore, it is not possible to form a meaningful opinion on the novelty and inventive step of their subject-matter.
- 1.3 Claims **38-41** are unclear for the same reasons as claims 9-12.
- 1.4 Claims **59 and 63** refer to a step which "is to encourage" a concentration gradient. Since the formulation appears to relate to the purpose of a process step (which

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB99/00741

may or may not be achieved), the technical implications are entirely unclear.

- 1.5 Claim 4 refers to a difference in "affinity". The meaning of this expression is not clear in the sense of Art. 6 PCT.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 91242/PRS	FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. PCT/GB 99/ 00741	International filing date (day/month/year) 12/03/1999	(Earliest) Priority Date (day/month/year) 13/03/1998
Applicant CAMBRIDGE DISPLAY TECHNOLOGY LTD et al.		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 3 sheets.



It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

- a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.



the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

- b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :



contained in the international application in written form.



filed together with the international application in computer readable form.



furnished subsequently to this Authority in written form.



furnished subsequently to this Authority in computer readable form.



the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.



the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,



the text is approved as submitted by the applicant.



the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,



the text is approved as submitted by the applicant.



the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.



as suggested by the applicant.



because the applicant failed to suggest a figure.



because this figure better characterizes the invention.

12
☐ None of the figures.

INTERNATIONAL SEARCH REPORT

International Application No

P/B 99/00741

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H01L51/20

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 H01L H05B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	PATENT ABSTRACTS OF JAPAN vol. 097, no. 007, 31 July 1997 -& JP 09 082473 A (CASIO COMPUT CO LTD), 28 March 1997 see abstract; figures -& US 5 834 894 A (SHIRASAKI T ET AL) 10 November 1998 ---	1, 36, 55, 56, 60
A	YANG Y ET AL: "POLY(1,4-PHENYLENE-1,2-DIPHENYLVINYLENE) AND TRIS(8-QUINOLINOLATO) ALUMINUM BILAYER LIGHT-EMITTING DIODES" POLYMERS FOR ADVANCED TECHNOLOGIES, vol. 8, no. 7, 1 July 1997, pages 431-436, XP000695524 see the whole document --- -/--	1, 36, 55, 56, 60

☒ Further documents are listed in the continuation of box C.

☐ Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

6 July 1999

Date of mailing of the international search report

15/07/1999

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INTERNATIONAL SEARCH REPORT

International Application No

GB 99/00741

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GARTEN F ET AL: "EFFICIENT BLUE LEDS FROM A PARTIALLY CONJUGATED SI-CONTAINING PPV COPOLYMER IN A DOUBLE-LAYER CONFIGURATION" ADVANCED MATERIALS, vol. 9, no. 2, 1 February 1997, pages 127-131, XP000681079 cited in the application see the whole document ----	1, 36, 55, 56, 60
A	HOSOKAWA C ET AL: "HIGHLY EFFICIENT BLUE ELECTROLUMINESCENCE FROM A DISTYRYLARYLENE EMITTING LAYER WITH A NEW DOPANT" APPLIED PHYSICS LETTERS, vol. 67, no. 26, 25 December 1995, pages 3853-3855, XP000548843 cited in the application see the whole document -----	1, 36, 55, 56, 60